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Use It or Lose It? A Longitudinal Performance Assessment of Undergraduate Business Students' Information Literacy

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Abstract

At a large, public, Midwestern, American university, business librarians teach a required, one-credit information literacy course geared towards lower-division students in the school of management. In order to determine the lasting effects of the course, a longitudinal study of individual students' performance on three pre/post-test surveys was conducted across a set of management courses. The first course, a required information literacy class, was generally taken in the lower-division. The second course, a career strategies course, is generally taken after the first information literacy class. Students who took both required courses displayed greater information literacy knowledge and skills than students who took only the second course. Students retained the information uniformly over time, as time between the two courses did not yield a significant difference in scores. These findings show information literacy courses have a lasting impact on lower-division students as they progress through a college program.

Keywords: information literacy, assessment, longitudinal studies, for-credit courses

Introduction

There is increasingly more pressure placed on libraries to demonstrate their value to stakeholders in quantifiable ways (Oakleaf, 2008; Menchaca, 2014; Holliday et al., 2015; Sharun, 2014; Booth et al., 2014). In the case of libraries playing a role in instruction at higher education institutions, this requires showing "what students know and are able to do as a result of their interaction with the library and its staff" (Oakleaf, 2008, p.234). Standalone subject-specific information literacy classes taught by librarians (or those courses included in learning communities) have been shown to positively impact students' information literacy within their academic program, since the instructors emphasize and prioritize information literacy instruction throughout the duration of the course (Burgoyne & Chuppa-Cornell, 2015; Lebbin, 2005; Mery et al., 2012). Librarians recognize that what they teach has lasting value for students, but they have little quantifiable evidence that students retain knowledge of those valuable skills later in the curriculum.

This paper presents a study conducted at a large, public, Midwestern, American university, where business librarians teach a required, one-hundred level, single credit business information literacy course geared towards lower-division students. In order to determine the lasting impact the course has on students' business information literacy, a longitudinal study of individual students' performance on three pre/post-test surveys was conducted across management courses, Information Strategies for Management Students (hereafter C1) and Management Career Lectures (hereafter C2). The study demonstrates that students retained their knowledge of the information first encountered in C1, as their test scores remained steady over time. Students who took both required courses displayed greater information literacy knowledge

and skills than students who took only C2. Students who took the two courses further apart also performed similarly on their pre/post-tests than students who took less time between taking the two courses. These findings show how information literacy courses have a lasting impact on lower-division students as they progress through a college program.

Literature Review

Our study focuses on the longitudinal effects of information literacy instruction on undergraduate students, as well as how different courses within a program impact student performance outcomes. In order to situate these areas of interest within a broader context, this literature review focuses on the following bodies of research: information literacy research, assessment in higher education, pedagogical practice, and curriculum development. First, we reviewed library and information science literature, in order to see how librarians implement information literacy instruction in programmatic curricula and how they assess the outcomes of their instructional efforts. Next, we widened our search to education literature, in order to find instances in which instructors studied the effect the timing of courses has on student learning. Finally, we sought background knowledge on pedagogy and cognitive psychology, in order to see how instructors teach for long term positive effects on student learning. The following literature review presents relevant research on longitudinal information literacy assessment, course sequencing for curriculum development, and scaffolded librarian-led instruction.

Information Literacy Assessment and Longitudinal Studies

There are several common types of information literacy instruction assessment, including fixed choice tests, performance assessments, and rubrics (Oakleaf, 2008), each of which has a history of use and theoretical background supporting its implementation. Many libraries opt for

fixed choice tests, which allow for fast development and grading, are typically scalable and reliable, and support convenient comparisons of study groups (Oakleaf, 2008).

Pre/post-tests—either standardized or locally developed—are commonly used to measure the impact of one-shot information literacy sessions (Bryan & Karshmer, 2013; Fain, 2011; Riddle & Hartman, 2000), stand-alone information literacy courses (Mery et al., 2012; Stonebraker, 2015), as well as students' information literacy over time. Pre/post-tests are often used to study students' confidence levels or their perceptions of the impact of an information literacy intervention (Chen, 2012; Ferrer-Vincent et al., 2015; Freeman & Lynd-Balta, 2010), as well as their information literacy knowledge or skills. Several researchers tested students' perceptions of their information literacy capabilities, as well as their performance on a pre/post-test assessment before, immediately after, and at a fixed time following an information literacy intervention, in order to determine if information literacy instruction (course-based or by teacher-demand) has a lasting effect on students later in their academic programs (Fuselier & Nelson, 2011; Bruehl et al., 2015; Gunn & Miree, 2012; Hristova & Miree, 2013).

Libraries also examine GPA scores and student retention, in order to study the long term effects of information literacy instruction. Studies show increased positive effects of library instruction if tiered in the upper division (Bowles-Terry, 2012). However, confounding variables, such as a student's major, limit these studies from making correlations between grades, student success, and true performance.

Course Sequencing and Timing

Researchers from several disciplines, including psychology, communications, accounting, and chemistry, studied the sequencing or timing of programmatic courses in relation

to curriculum planning and development. Researchers examine the most effective ways in which students are exposed to content and methodology, in order to provide recommendations for altering curriculum requirements and enhancing student grades. Barron et al. sought to determine when undergraduate students should take methods and statistics courses relative to one another within a psychology program, in order to study how the sequencing of classes affects students' grades and performance on exit exams (Barron et al., 2014). Richards focused on how the sequencing of courses within communications departments can enhance students' grade performance during their course of study (Richards, 2012). Goess also showed how the placement of organic chemistry courses can positively impact students' content knowledge and reinforce fundamental disciplinary concepts throughout a sequenced program (Goess, 2014).

The education literature, however, lacks research on the sequencing of information literacy courses and how the timing and ordering of courses affect student learning. Holliday and Fagerheim studied the sequencing of information literacy components within two required English composition courses, in order to create a more comprehensive, localized information literacy program (Holliday and Fagerheim, 2006). Verhey also studied the inclusion of information literacy elements across multiple courses within a nursing program, in order to determine if the program enabled students to demonstrate better use of bibliographic databases and academic journals for various course assignments (Verhey, 1999). These studies only look at the effectiveness of embedded information literacy instruction, where information literacy is not the primary learning outcome. We intend to study how the sequencing of two standalone information literacy courses impacts business students' retention of information literacy knowledge and skills within a management program.

Information Literacy Assessment in Business Disciplines

Expanding upon the American Library Association's 1989 Presidential Committee on Information Literacy Final Report's definition of information literacy, Cooney defined business information literacy as "specific programs and practices that your library utilizes to help business students 'recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information'" (Cooney, 2005, p.10). Natt conducted a content analysis of the literature to determine the prevalence of business information literacy in scholarly communication and found that despite the growing number of articles that mention the topic between 2001 and 2012, there are significantly fewer articles that focus specifically on business information literacy (Natt, 2013). Cooney found that while information literacy is increasingly implemented in the business classroom, there is a low percentage of instructors who utilize the Association of College and Research Libraries' (ACRL) Information Literacy Competency Standards for Higher Education for instructional design and an even lower number of instructors who directly assess students' business information literacy (Cooney, 2005).

Gunn and Miree assessed the performance of freshman and senior business students on a pre/post-test measuring business information literacy before and after an information literacy tutorial, in order to demonstrate that intentional information literacy interventions are necessary occurrences throughout an undergraduate business program (Gunn and Miree, 2012). While promising, the study did not find any statistically significant results. Additionally, student participation was voluntary, which may have resulted in unintentional sampling error. In their follow-up longitudinal study, which did not track students' individual performance, the authors compared groups against one another, in order to determine students' knowledge retention over

the course of a business program (Hristova and Miree, 2013). Our study assesses students at the individual level, allowing for a nuanced view of the way in which students retain information literacy knowledge and skills over time.

Scaffolding

Salisbury et al. emphasize the need to make students' information literacy skills replicable over time and across disciplines, specifically arguing that through scaffolding instruction, students can "build, apply, and practice basic generic skills in a non-confronting and comfortable learning environment," preparing them for future discipline-specific learning activities (Salisbury, 2012, p.10). Scaffolding allows students to learn and create meaning from instructional experiences, as they build off and utilize prior knowledge during the process (Walton and Archer, 2004). The intention of scaffolding is to provide students with sufficient practice with increasingly complicated tasks or content knowledge over time, ideally resulting in students who are capable of flexibly transferring developed skills or knowledge to new situations.

Researchers tend to agree that utilizing prior knowledge and calling upon students' previous experiences during instruction provides opportunities for deeper learning and better transfer. Walton and Archer found during a study of first-year engineering students' web literacy at the University of Cape Town that despite the intentional scaffolding of content and skills implemented within the curriculum, students had difficulties transferring what they previously learned about online searching to new contexts. The authors suggest that students need consistent practice and instruction, in order to be able to generalize techniques and content knowledge to other situations (Walton and Archer, 2004). While this study suggests that students are

unsuccessful at transferring knowledge and skills to new situations, the study does not provide longitudinal or quantifiable analysis of students' actual performance on assessments, which could shed more light on the varied ways students retain and transfer knowledge and skills after instructional interventions.

Previous C1 pre/post-test study

C1 pre/post-test was previously studied by one of the authors of this paper. C1 students (N=514 pre, N=472 post) scored higher on post-tests than the pre-tests at a highly significant level (p= .001) (Stonebraker, 2015).

Despite the positive impact C1 has on students' business information literacy, demonstrated through improvement between their pre/post-test scores, questions remained. We were concerned that students were not retaining the content knowledge and retrieval skills introduced in C1 beyond the eight-week course. There was a lack of longitudinal studies of students' knowledge retention within a program of study that we could use as comparisons for C1 students' knowledge retention. Given the large institutional investment in an information literacy class in the lower-division, it was important to prove that the course has a demonstrable impact on the students as they moved through the program. Additionally, we wanted to understand whether this positive impact on students' performance on the pre/post-tests increased or decreased if the students took the two information literacy courses further apart.

In order to study the long-term impact C1 has on students' business information literacy within the general scope of the management program, we implemented a longitudinal study tracking individual undergraduate students from C1 to C2. Specifically, we focused on two research questions:

Q1: What are the long term performance effects on individual students of C1? Do students retain the information over time?

Q2: How does the time (measured in mods, or 8 week intervals) between courses (C1 and C2) affect students' performance?

Methods

The management program requires students to take C1 and C2. C1 is a single credit information literacy course. In C1, students complete identical pre/post-test surveys at the beginning and end of the eight-week course. C2, a one-credit course focused on career development, also integrates information literacy within the curriculum through modules on the job search, in order to prepare students to identify and research companies in preparation for job interviews. While students are not required to take C1 or C2 at a specific time in the program, students typically take C1 before C2.

Students took the same online pre/post-test survey administered through Qualtrics, a web-based survey platform, at three individual points across the span of the management courses (Qualtrics, Provo, UT). The survey measured students' knowledge of business resources, as well as students' ability to recognize when different types of information are needed to answer specific business questions. For example, one question (Table 1) requires students to know which common business resources have information that could help them solve a problem pertaining to recycling plastics. Other questions require students to know what business databases include certain types of information, such as market and industry reports or newspapers (see Appendix for complete list of questions included in the survey). We coded for correct answers with a range of points from 0 to 2. For the analysis, only quantitative questions (not qualitative open response questions) were included.

[INSERT TABLE 1 ABOUT HERE]

Students took the pre/post-test survey for completion points eight weeks apart--at the beginning and end of C1, as well as a third time at the end of C2's sixteen-week course. Students who took C2's post-test survey did so voluntarily for five points extra credit (less than 1% of their total possible course grade). Students did not get feedback on their pre-test or post-test score, only completion points. The study applied for IRB exception under Category 1 (research conducted in education settings) and received approval.

We coded seventeen of the fixed-answer, quantitative survey questions (with a total of 82 possible points) which dealt with locating and evaluating necessary information for solving business problems through the Qualtrics platform, and we exported students' test scores into Excel sheets for individual sections of the courses. Next, we tracked individual students enrolled in C2 who took the extra credit survey and had also taken C1 (N=26) from sections of C1 to sections of C2, where we aggregated their three scores into a single Excel file before importing the data into SPSS, an IBM statistical analytics software, for descriptive data analysis (SPSS 23).[1] We also gathered the post-test scores for students who only took C2 (N=79), in order to compare students who took both C1 and C2 to students who only took C2.

Results

Our first research question (Q1) sought to determine the long term effects C1 has on students' business information literacy, compared with students who had not taken C1 (Group 2).

[1] The sample of Group 1 students is different between the C1 pre-test (N=26) and the C1 post-test, C2 post-test (N=31). We had five students who joined C1 too late to take the C1 pre-test, so we did not have equal scores across the three assessment points. For our analysis, we ran a repeated measures test, which only accepts students with all three scores.

To answer this question, we examined the mean score differences on the C2 post-test between Group 1 students (those who had taken C1) (M=64.77) compared to Group 2 students (those who did not take C1) (M=60.15). We found that the differences between the two groups were statistically significant ($t(118)=2.731$, $p=0.007$). We then used a Cohen's d effect size to examine the magnitude of difference between their average scores. We found that the differences between the two groups fell in the moderate level ($d=0.51$). This effect size is above documented levels of practice effect (Donovan & Radosevich, 1999). While there were small fluctuations in Group 1 from C1 post-test (the second point of assessment) to C2 post-test (the third point of assessment), the differences were not significant (see Table 2 and Figure 1, Group 1A &B).

[INSERT TABLE 2 ABOUT HERE]
[INSERT FIGURE 1 ABOUT HERE]

In comparison to Group 1 students, students who only took C2 (Group 2) had a statistically significantly lower mean C2 post-test score ($t(108)=2.495$, $p=.014$). We can attribute this difference between the two groups' performance on the C2 post-test to the students' enrollment in C1, as we compared Group 2's mean C2 post-test score to Group 1's C1 pre-test. This comparison would determine whether the groups were performing significantly differently from one another at the onset on information literacy instruction. We ran an independent samples t-test and found that the groups (Group 1 and Group 2) started out similarly to each other ($p=0.481$).

Our second research question sought to determine whether taking the two information literacy courses at different times in one's academic program impacts students' performance on the pre/post-test surveys in the long run. We measured long term effects by tracking the amount of time that elapsed between students' enrollment in C1 and C2. C1 was a half semester course;

therefore, we calculated the time intervals between C1 and C2 in mods, or eight-week increments, for each student. We divided our Group 1 sample into two groups--Group 1A, for students who took C1 1-3 mods prior to C2, and Group 1B, for students who took C1 4-7 mods before C2. See Table 2 for means and standard deviations (Group 1A and Group 1B).

To study the differences between Group 1A and Group 1B, we utilized a generalized estimating equation (GEE), a repeated-measures regression model that allows for analysis of longitudinal, not normally distributed data for independent subjects, (Ballinger, 2004). The resulting GEE indicates that student performance is not impacted by the amount of time elapsed between the initial information literacy course and subsequent courses (X^2=1.396, p=0.498). We then analyzed the mean differences between Group 1A and Group 1B using an independent sample t-test, which resulted in a Cohen's d effect size of d=0.35, which falls within the small effect category (Williams et al., 2015, p. 810) and indicates that there was no statistical significance, confirming the GEE.

Discussion

Months or even years later, students who took C1 followed by C2 (Group 1) scored higher on C2's post-test than students who did not take C1 (Group 2). Duration of time between students' enrollment in the two courses did not have an effect on information literacy outcomes; students retained the same level of information consistently over time.

Students who did not take the first information literacy course (C1) did not gain the skills in other ways during the course of the management program. Group 2 students' C2 post-test scores were similar to Group 1 students' C1 pre-test, indicating that students do not naturally pick up information literacy skills and knowledge over time in the curriculum. Group 2 students'

information literacy knowledge and skills are similar to those of a freshmen student who has not received explicit information literacy instruction (see Figure 1).

In this study, we sought to explore the effect time has on the learning gains of a for-credit information literacy course. Often instructor variability is an issue for studies of student learning. The instruction teams for C1 and C2 remained the same throughout the years of this study, and the structure of both courses remained the same with no major revisions in learning objectives. C2 instructors did not know which students previously took C1 and therefore could not manipulate results. Since the survey was required for completion points by all C1 students, sampling bias is minimal, though it is possible for students in C2, who took the survey for extra credit.

The C1 information literacy course is designed for freshmen or sophomore level students, but targeted to business students. The phenomenon of long term knowledge retention is discipline-specific and complicates the 2012 Bowles-Terry study results, which indicate that upper-level instruction positively impacts student learning, whereas freshmen level instruction does not yield significant results. Yet, the freshmen-level instruction in the Bowles-Terry study was not discipline-specific and focused on a required general course. Our study suggests that discipline-specific instruction, even in the lower-division, can yield significant, positive results that can influence pedagogy and student learning.

While our results are significant, they are by no means able to speak for the whole of information literacy instruction efforts. This study was conducted within relatively strict confines of two single credit courses within the school of management. Due to the short duration of the study, the sample size is small and prone to possible sampling error. As students were required to

take both C1 and C2, we may be missing students who dropped out of the program or had not completed both requirements at the time the data was collected.

For this study, we chose to focus on students who took C1 followed by C2, though we did have some students (n= 3) who took C2 before C1. Since the sample was small, we did not include them in our study, though we may examine them in later studies to fully understand the relationship between the two courses and students' knowledge retention. In future studies, we would also like to highlight the effect of taking the two classes concurrently.

More studies would need to be conducted in other departments to assess whether information literacy may manifest itself differently in an English or nursing context. Our focus in this study is on the quantitative scores, which may not tell the full story of how students use information. In the future, we plan to gather both qualitative and quantitative information from the students, to assess whether they are aware of their knowledge utilization and if so, in what ways their skills are reinforced throughout the program. We are also examining our options for long term assessment of the students' knowledge retention as they enter the workforce and need to solve business problems.

Conclusion

In higher education, librarians are in a unique position to reach students at multiple points in their academic careers through invited instruction, online tutorials and for-credit classes. In this study we highlighted a method for librarians to show how their long term value lasts beyond individual courses. Librarians are increasingly looking to map their information literacy efforts across curricula in an effort to allocate resources (Buchanan et al., 2015). As librarians map

information literacy instruction, they should also map their assessment efforts to see if previous information literacy instruction efforts have been successful.

Our results provide quantifiable evidence that librarian-led classes, especially in discipline-specific contexts, such as a school of management, make an impact on student learning. Our results are also of use to academic departments who are interested in determining when credit bearing information literacy courses create the most effect on students within a program. As librarians highlight the value their instruction brings to disciplinary contexts, it is our hope that they continue to assess long term impact for lasting improvement of student performance. In the Framework for Information Literacy for Higher Education, information literacy is envisioned as "extending the arc of learning throughout students' academic careers" (American Library Association, 2015). As librarians, it is our charge to study this arc, in order to understand where best to amplify, instruct and highlight information literacy success within higher education.

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